

A SYNOPSIS OF THE GENUS *HALENIA*  
(GENTIANACEAE) IN MEXICO

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ABSTRACT

An abbreviated revision of the Mexican representatives of the genus *Halenia* Börckh. (Gentianaceae) is provided. Descriptions, comments and distribution data with citation of some of the examined specimens is presented for the twelve species known to occur in Mexico. Two new species, *Halenia alleniana* and *H. crumiana*, are validated.

Key Words: *Halenia*, Gentianaceae, Mexico

The genus *Halenia* Börckh. is an almost exclusively American genus belonging to the Gentianaceae—Gentianeae and comprised of perhaps as many as seventy species according to the most recent revision of the genus (Allen, 1933). Allen's studies indicate that more than seventy percent of the species are restricted to Andean South America and most of the remainder are found in the mountains extending from the southwestern United States to western Panama. Apparently a single species ranges across most of the northern United States and Canada from Newfoundland to British Columbia. The type of the genus, *H. corniculata* (L.) Cornaz, is one of the very few non-American species in the genus and that Asian species ranges from the Urals to eastern Siberia and south into Manchuria and Mongolia. A second Asiatic species, *H. elliptica* D. Don ex G. Don, was described from the Himalayas and apparently extends north into Soviet Central Asia and China.

The genus has proven to be a difficult one owing at least in part to the considerable plasticity of the plants involving even the most fundamental diagnostic characters used in distinguishing the various taxa, the corolline spurs. Opportunity for extensive observations on the plants in their natural habitats seems a prerequisite for understanding much of the puzzling variation encountered within the genus and both the present study and the previous study by Allen (1933) suffer from the fact that they have been almost exclusively based upon herbarium investigation. It would also seem that the genus would yield results of greatest biological interest from an investigation of pollination biology of the various species since much of the most conspicuous variation is



based in nectariferous spurs which vary strikingly in size, shape and posture. Unfortunately this paper is not a report of such a study. Instead of these promising approaches to the considerable and puzzling variation that exists within the genus, the present report is the result of study of approximately two thousand specimens of *Halenia*, from Mexico and Central America. In the more than half century that has elapsed since Allen revised the American species in her doctoral dissertation, Mexico has been the site of considerable collecting and as a consequence there is now a far more ample series of specimens than what was available to her. Still, it would be very much a mistake to conclude that botanical collecting in Mexico is approaching the point of adequacy, and that collectors might be well advised to abandon general collecting and concentrate their efforts almost exclusively upon their own special group. In fact the evidence seems to me conclusive that there has been far too much emphasis by "collectors" on the intensive study of their narrow special interest and a neglect of general collecting, except by those who are preparing regional or state floras. Careful, critical collecting is very much needed in most parts of Mexico and will be necessary for decades to come. The present synopsis is offered to provide a more realistic account of the genus and consequently prove useful to those who might be tempted to work with these most interesting plants living as they do in some of the most scenic areas in Mexico.

#### GENERIC DESCRIPTION

*Halenia* Börckh., Arch. Bot. (Leipzig) 1: 25. 1796. *nom. cons.* TYPE: *Halenia sibirica* Börckh., *nom. illeg.* [= *Swertia corniculata* L., *Halenia corniculata* (L.) Cornaz].

*Tetragonanthus* Gmel., Fl. Sibirica 4: 114, pl. 53. 1769. *nom. illegit.* (Art. 34.1d). *Ceratia* Pers., Syn. Pl. 1: 287. 1805, non Adans., Fam. 2: 319, 535. 1763 (= *Ceratonia* L.)

*Exadenus* Griseb., Gen. Sp. Gentian. 322. 1838. LECTOTYPE: *E. brevicornis* (H.B.K.) Griseb.

Annual, biennial or perennial, glabrous, caulescent herbs. Leaves decussate, opposite or rarely whorled, entire, membranous to fleshy, sessile or petiolate, usually 3-5-veined. Inflorescence a terminal or axillary, subumbellate or rarely racemose to spicate cyme. Calyx deeply 4-parted with the lobes only basally united and often bearing squamellae internally at the base of each lobe, the lobes somewhat



inconspicuous to foliaceous, linear, lanceolate or ovate to spatulate, often marginally papillate. Corolla 4-parted, usually greenish yellow or rarely whitish or purplish, marcescent; lobes dextrorsely convolute, elliptic to ovate, obtuse to acute or acuminate, entire to erose, often marginally papillate. Stamens 4, inserted on the corolla-tube and alternating with the lobes; filaments linear or occasionally basally dilated; anthers versatile, ovate, oblong or subtriangular. Pistil bicarpellary; stigma sessile with 2, oblongish lobes 3–4 times as long as thick and these receptive on the inner surface; style lacking; ovary sessile, 1-celled with two parietal placentae bearing numerous ovules. Capsule compressed, septicidally dehiscent from the apex; seeds globose to elliptic and slightly flattened with a granular to reticulate surface.

A genus of perhaps 70 species with most of the American species found in Andean South America with a smaller center of variation in Central America and Mexico.

Allen (1933) recognized two formal sections within the American species of the genus *Halenia*: *Swertiella* and *Haleniastrum* (= *Halenia*). These were distinguished by her diagnostic key as follows:

Plants usually coarse with fleshy leaves, rarely slender with thin, herbaceous leaves; stem usually leafy; spurs absent, or present as very small inconspicuous protuberances, frequently obscured by calyx; distribution chiefly South America . . . . .

. . . . . 1. *Swertiella*

Plants usually slender, with thin, herbaceous leaves, stems leafy or scapose; spurs present; distribution North and South America . . . . . 2. *Haleniastrum*

According to Allen, *Halenia alata* and *H. brevicornis* are the two species from North of South America belonging to her section *Swertiella*, while the remaining species belong to what we would call section *Halenia* and which she designated as section *Haleniastrum*. I am not convinced that the late Caroline K. Allen has delimited natural subgeneric groupings within the genus *Halenia* but am unable to suggest a more meaningful grouping or infrageneric classification at this time.

#### KEY TO THE MEXICAN SPECIES OF *HALENIA*

1. Plants annual or biennial . . . . . (2)
2. Corolline protuberances either lacking or less than 2 mm long



- and not developed into conspicuous nectariferous spurs or horns ..... 1. *H. brevicornis*.
2. Corolline protuberances well-developed and usually represented by nectariferous spurs 3 mm long or longer.
3. Corolline spurs either strongly divergent or at least spreading outwardly and distally arching outwardly.
4. Corolline spurs so strongly divergent as to be horizontal or nearly so; corolla lobes  $\pm$  acute; midcauline leaves mostly linear, usually less than 4 mm wide .....  
..... 2. *H. recurva*.
4. Corolline spurs diverging especially distally but not more than  $30^\circ$ ; corolla lobes rounded to obtuse; midcauline leaves elliptic, usually 4 mm or more wide .....  
..... 3. *H. crumiana*.
3. Corolline spurs  $\pm$  pendent and often distally inwardly curved.
5. Midcauline leaves linear, mostly 10 or more times as long as wide ..... 4. *H. palmeri*.
5. Midcauline leaves oblong to lanceolate or broadly elliptic or ovate, much broader than 6 times as long as wide.
6. Calyx lobes spatulate, obtuse .....  
..... 5. *H. konzattii*.
6. Calyx lobes oblong to lanceolate or elliptic, acute.
7. Midcauline leaves ovate to broadly lanceolate, clearly slenderly petiolate with the petioles 3–12 mm long; basal leaves with petioles 10–30 mm long and about as long or even longer than the blades; capsules 15 mm long or less .....  
..... 6. *H. schiedeana*.
7. Midcauline leaves oblong to oblanceolate; tapering to a rather broad base or at most very indistinctly winged-petiolate; capsules (12) 15–25 mm long .  
..... 7. *H. alleniana*.
1. Plants perennial.
8. Corolline nectaries merely pouch-like or at least not developed into spurs more than 1.5 mm long.
9. Calyx lobes obtuse; corolla 6 mm long or less; corolline nectaries pouch-like, drying dark brown .....  
..... 8. *H. alata*.



9. Calyx lobes acute to acuminate; corolla 6 mm long or longer; corolline nectaries never drying as dark brown circular patches ..... 9. *H. pringlei*.
8. Corolline nectaries typically spur-like and longer than 2 mm.
10. Corolline spurs strongly divergent or outwardly spreading.
11. Plants usually 1–5 dm tall or less; corolline spurs horizontally spreading or at least very strongly divergent; cauline leaves mostly linear to oblanceolate, mostly 6 mm wide or less ..... 9. *H. pringlei*.
11. Plants 1.5 dm tall or more; corolline spurs slender and more than 4 times as long as the diameter and these more or less descending or if moderately spreading never approaching the horizontal; cauline leaves mostly broadly elliptical, about 1 cm wide .....  
..... 10. *H. hintonii*.
10. Corolline spurs  $\pm$  pendulous and neither divergent nor conspicuously outwardly curved, often distally straight.
12. Basal rosette absent or at least the leaves mostly cauline ..... 11. *H. decumbens*.
12. Basal rosette present and cauline leaves few or none.
13. Spurs distally incurved, less than half the length of the corolla.
14. Flowers more than 10 mm long; corolline spurs usually  $1/3$ – $1/2$  the length of the corolla, 3–7 mm long ..... 12. *H. plantaginea*.
14. Flowers less than 10 mm long; corolline spurs rudimentary and usually 2.5 mm long or less .  
..... 13. *H. nudicaulis*.
13. Spurs  $\pm$  straight or distally slightly outwardly curved, about half the length of the corolla .....  
..... 11. *H. decumbens*.

## TREATMENT OF INDIVIDUAL TAXA

1. ***Halenia brevicornis*** (H.B.K.) G. Don, Gen. Hist. 4: 177. 1838.  
*Swertia brevicornis* H.B.K., Nov. Gen. et Sp. Pl. 3: 174. 1818. TYPE: Ecuador;  
Quito, *Humboldt & Bonpland s.n.*  
*Swertia parviflora* H.B.K., Nov. Gen. et Sp. Pl. 3: 174. 1818. TYPE: Mexico;  
Guanajuato, *Humboldt & Bonpland*, photo of type at Paris seen at US.  
*Swertia parviflora* var.  $\alpha$  *angustifolia* Schlect. & Cham., Linnaea 5: 122. 1830.



- Swertia parviflora* var.  $\beta$  *latifolia* Schlect. & Cham., *Linnaea* 5: 122. 1830.
- Halenia parviflora* (H.B.K.) G. Don, *Gen. Hist.* 4: 177. 1838.
- Exadenus brevicornis* (H.B.K.) Griseb., *Gen. et Sp. Gent.* 323. 1839.
- Exadenus parviflorus* (H.B.K.) Griseb., *Gen. et Sp. Gent.* 322. 1839.
- Exadenus parviflorus* var.  $\beta$  *latifolius* (Schlecht. & Cham.) Griseb., *Gen. & Sp. Gent.* 322. 1839.
- Halenia multiflora* Benth., *Pl. Hartw.* 24. 1839. Mexico: in pinetis Bolaños, *Hartweg 210* (K, HOLOTYPE, photo!; NY! ISOTYPE).
- Exadenus paucifolius* Mart. & Gal., *Bull. Acad. Brux.* 11: 372. 1844. TYPE: Se trouve avec l'espece précédente [*E. alatus* Mart. & Gal.] de 9 a 12,000 pieds ["du pic d'Orizaba"], *Galiotti 7219* (BR, HOLOTYPE, photo!).
- Halenia paucifolia* (Mart. & Gal.) Hemsl., *Biol. Centr. Amer. Bot.* 2: 352. 1882.
- Halenia parviflora* var. *latifolia* (Schlect. & Cham.) Hemsl., *Biol. Centr. Amer. Bot.* 2: 351. 1882.
- Tetragonanthus paucifolius* (Mart. & Gal.) Kuntze, *Rev. Gen. Pl.* 2: 431. 1891.
- Tetragonanthus parviflorus* (H.B.K.) Kuntze, *Rev. Gen. Pl.* 2: 431. 1891.
- Tetragonanthus brevicornis* (H.B.K.) Kuntze, *Rev. Gen. Pl.* 2: 431. 1891.
- Swertia cucullata* Sessé & Mocino, *Fl. Mex. ed. 2* p. 73. 1894. TYPE: Mexico, *Sessé & Mocino s.n.* (MA, HOLOTYPE, photo at MO!).
- Halenia erythraeoides* Gilg, *Engler Bot. Jahrb.* 54: Beibl. 118, p. 105. 1916. TYPE: Venezuela: "Auf den Hochanden von Merida", *Linden 456* (B, HOLOTYPE).
- Halenia micranthella* Briq., *Candollea* 4: 320. 1931. TYPE: Mexico; Hidalgo, wet meadows, Sierra de Pachuca, alt. 2450 m, *Pringle 6964* [as 1964] (G, not seen, HOLOTYPE; ENCB! F! MICH! MO! MSC! NY! PH! US! ISOTYPES).
- Halenia tuerckheimii* Briq., *Candollea* 4: 317. 1931. TYPE: Guatemala; Alta Verapaz, "Fichtenwälder bei San Joaquin" 1000 m, *von Tuerckheim 2041* (G, HOLOTYPE; F! GH! NY! US! ISOTYPES).
- Halenia brevicornis* var. *multiflora* (Benth.) C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 142. 1933.
- Halenia brevicornis* var. *micranthella* (Briq.) C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 143. 1933.
- Halenia brevicornis* var. *divergens* C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 144. 1933. TYPE: Mexico; Michoacán, vicinity of Morelia, near La Huerta, 1950 m, 1 Sept. 1910. *Arsène s.n.* (MO! HOLOTYPE; US! ISOTYPE).
- Halenia brevicornis* var. *chihuahuensis* C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 144. 1933. TYPE: Mexico; Chihuahua, pine plains, base of the Sierra Madre, *Pringle 1664* (MO! HOLOTYPE; CAS! MSC! ISOTYPES).
- Halenia brevicornis* var. *ovata* C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 145. 1933. TYPE: Mexico; Nayarit, Tepic, Jan 5–Feb 6, 1892, *Palmer s.n.* (US! HOLOTYPE).
- Halenia brevicornis* var. *tuerckheimii* (Briq.) C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 145. 1933.

Annual herbs (0.5)1.5–4(9) dm high from a slender tap root; stems slender, strongly angled to even quadrate, striate, usually branched only above the base. Leaves mostly cauline, thinly membranous, sessile or only the lowermost petiolate (the petioles in these 0.5–1.5(3.0) cm long), the blades linear to lanceolate or elliptic,



mostly 2–3.5(5) cm long and (1)2–10(18) mm wide. Inflorescence cymosely racemiform to paniculate, compactly congested to loosely arranged; pedicels 1–12(25) mm long. Calyx tube shallowly turbinate to campanulate, 0.3–0.6(0.8) mm high, the lobes linear to lanceolate or more rarely oblong or narrowly spatulate,  $1/2$ – $3/4$  the length of the corolla, mostly (1.5)2–4 mm long and 0.2–0.6 mm wide, usually faintly 3-nerved, marginally often minutely papillate; corolla green to greenish yellow, 4–8 mm long, the tube 3–4.5 mm long, the lobes broadly to narrowly ovate to deltoid-oblong, apically acute to acuminate and basally somewhat auriculate, 2–3 mm long, spurs lacking or marked by slight protuberances or represented by readily detected, pendant to divergent spurs 0.5–1.0(2.0) mm long; stamens 2–4 mm long, the filaments attached near the middle of the corolla-tube. Capsule compressed, lanceolate, 5–9(–14) mm long; seeds ovoid to subglobose, 0.4–0.6 mm long, reticulate.

**DISTRIBUTION.** Dry, grassy slopes and open woods from n. Mexico south through Central America into northwestern South America.

This species has been divided by Allen (1933) into eight varieties thought by Williams (*Fieldiana Bot.* 24: 317. 1969) “to have slight if any systematic importance.” My own findings are in agreement with those of Williams. Allen, although stating “that environment is in a large measure responsible for the variation found within the species,” keyed what she treated as varieties as follows:

- a) Leaves not ovate, longer than 1.2 cm long.
- b) Pedicels stouter than filiform, shorter than 1.2 cm long.
- c) Corolla without distinct spurs.
- d) Inflorescence compact.
- e) Leaves linear, slender . . . . . var. *brevicornis*
- e) Leaves ovate to lanceolate, coarse . . . . .
- . . . . . var. *latifolia* (Schlecht. & Cham.) C. K. Allen
- d) Inflorescence strict . . . . .
- . . . . . var. *micranthella* (Briq.) C. K. Allen
- c) Corolla with small but distinct spurs.
- f) Spurs thick, conical, more or less pendulous . . . . .
- . . . . . var. *multiflora* (Benth.) C. K. Allen
- f) Spurs blunt, spreading squarrose . . . . .
- . . . . . var. *chihuahuensis* C. K. Allen
- f) Spurs slender, divergent . . . . . var. *divergens* C. K. Allen
- b) Pedicels filiform, slender, elongate; habit decidedly



- spreading . . . . .  
 . . . . . var. *tuerckheimii* (Briq.) C. K. Allen  
 a) Leaves ovate, shorter than 1.2 cm . . . var. *ovata* C. K. Allen

Naturally with so much described variation and so many formally named varieties of *Halenia brevicornis*, the suspicion is great that the easiest path has been followed in not recognizing any of them in this synopsis. Considerable opportunity to observe the plants in the field in a wide variety of habitats and throughout its range ought to help sort out at least some of the environmentally induced plasticity. The opportunity to grow the plants under controlled environmental conditions also gives promise of resolving this problem. But until such steps are taken, I believe it best to treat the species broadly as the problem seems not to lend itself well to analysis based upon the more traditional morphological-geographical analysis. I have not found Allen's treatment helpful in sorting out the populations into meaningful taxa and believe that much of the difficulty is traceable to the extreme plasticity of individuals responding to differences in light, available moisture and seasonality.

REPRESENTATIVE MEXICAN COLLECTIONS: **Baja California:** locality uncertain, "Lower California", *Orcutt s.n.* (NY). **Sonora:** pine slopes, La Mesa Colorado, 14 Oct 1933, *Gentry 542M* (DS, MICH, US); open pine forests, Saguaribo, Río Mayo, 5500 ft, 2 Nov. 1935, *Gentry 2099* (F, GH, MO, PH, US); slopes in oak forest on W slope of the Sierra Madre, 35 miles SW of Chuhuichupa on trail to Río Bonito, 2 Oct 1939, *Muller 3606* (GH, LL, MICH). **Chihuahua:** along arroyo just NW of Cusarare church, 2200 m, 14 Oct 1977, *Bye & Weber 8112* (LL, GH); Sierra Madre Mts., Mesa, W of Hop Valley, 6500 ft, 17 Sept 1903, *M. E. Jones s.n.* (F, MICH, MO, US); stony pineland, Madera, 2150–2200 m, Sierra Madre Occidental, 25 Sept 1934, *Pennell 19235* (PH, US); pine plains, base of the Sierra Madre, 4 Oct 1887, *Pringle 1330* (F, MICH, NY, PH, US). **Nuevo Leon:** open chaparral, upper west slope of Sierra de la Cebolla, 21 Aug 1939, *Muller 2898* (GH—a mixed sheet). **Sinaloa:** Sierra Surutato, 0.5 mi N of Los Ornos, 5800 ft, 1 Nov 1969, *Breedlove & Kawahara 16742* (CAS, MICH); steep moist slope, Sierra Surutato, 3 miles N of Los Ornos along road to Ocurahui, 2 Oct 1970, *Breedlove & Thorne 18338* (CAS, MICH). **Durango:** steep moist ravine 2 miles W of Revolcaderos along Mexican Hwy 40, 7100 ft, 8 Nov 1970, *Breedlove 18921* (CAS, MICH); open oak-pine woodland Sierra Madre Occidental about 50 km W of Ciudad Durango, 2550 m, 27 Sept 1962, *McVaugh 21661* (CAS, ENCB, LL, MICH, NY); dryish cliffs, 11.2 miles NE of El Paraiso (Sinaloa) on road between Villa Union and El Salto, 7800 ft, 29 Sept 1953, *Ownbey 1970* (F, GH, MICH, NY, US); rocky pineland canyon, El Salto (Aserraderos), 2500 m, 31 Aug 1934, *Pennell 18510* (GH, NY, PH, US); pumice gravel in dry pine-oak forest, 8600 feet, Sierra Madre, W slope, 17.5 miles, W of El Salto, 18 Oct 1965, *Ripley & Barneby 14176* (CAS, NY, US). **Zacatecas:** Sierra de Los Morones, near Plateado, 1 Sept 1897, *Rose 2732* (GH, US); about 38 km al W de Jalpa, sobre la carretera a Tlaltenango, bosque de *Quercus*, 21–23 Oct 1973.



*Rzedowski & McVaugh 975* (ENCB, MICH). **Aguascalientes:** moist N facing slopes near summits, Sierra del Laurel, about 10 miles SE of Calvillo, 2500 m, 4 Nov 1959, *McVaugh & Koelz 206* (MICH). **San Luis Potosi:** Alvarez, 28 Sept–3 Oct 1902, *Palmer 160* (F, GH, MO, NY, US); San Luis Potosi, 6000–8000 ft, 1878, *Parry & Palmer 600* (F, GH, MO, NY, PH, US). **Nayarit:** Tepic, *Palmer s.n.* (US). **Jalisco:** grassy slopes 12 km NW of Los Volcanes, 1900 m, 30 Oct 1973, *Breedlove 35772* (CAS, MICH); pine forest, Sierra de Manantlán, 15–20 miles SE of Autlán, about 1700 m, *McVaugh 13962* (MICH); in pine-oak woodland 5 miles NE of San Miguel de la Sierra, 1950 m, 2 Nov 1962, *McVaugh 22014* (MICH, NY); Río Blanco, Oct 1886, *Palmer 680* (GH, MICH, NY, US); banks of ravines near Guadalajara, 5000 ft, 21 Oct 1903; *Pringle 11636* (F, GH, US). **Guanajuato:** second growth oak forest on steep rocky mountainsides about 8 km NE of Santa Rosa, 2400 m, 10 Nov 1970, *McVaugh 24178* (MICH). **Hidalgo:** mountain meadows, El Chico near Pachuca, Sept 1905, *Purpus 1761* (F, GH, MO, NY, US). **Veracruz:** ladera de cerro en parcela de cultivo abandonado, 1700 m, 6 July 1970, *Ventura 1526* (DS, F, MICH, MO). **Michoacan:** llano about 4 km SW of Cerro San Andres about 10 km N of Ciudad Hidalgo, about 2930 m, 6 Sept 1960 *Beaman 4251* (GH, MSC); Zitácuaro—Las Cañas, 2600 m, 4 Nov 1938, *Hinton 13412* (GH, LL, MICH, NY, PH, TEX, US); Zitácuaro—Guanoro, 1875 m, 11 July 1938, *Hinton 13424* (GH, ILL, LL, NY, PH, TEX, US); pine forest, Tancitaro, 2250 m, 22 Nov 1940, *Hinton 15558* (DS, F, MICH, NY, US); pine-covered slopes and meadows about 18 miles S of Pátzcuaro, 8900–9000 feet, 20–25 Nov 1961, *King & Soderstrom 5156* (MICH, NY, TEX, US). **Mexico:** grassy hill, Tequesquipán, Dist. Temascaltepec, 2800 m, 28 Oct 1932, *Hinton 2316* (F, GH, LL, NY, PH, US); hill, Ocotepc, Dist. Temascaltepec, 1500 m, 9 Dec 1932, *Hinton 2905* (F, GH, LL, MO, NY, PH, US); pine forest, Nanchtitla, Dist. Temascaltepec, 16 Dec 1938, *Hinton 5354* (ENCB, F, MO, NY, US); llano, Sierrita, Dist. Temascaltepec, *Hinton 8311* (ENCB, F, GH, LL, MO, NY, PH, TEX, US); pine forest, Mezón Viejo, Dist. Temascaltepec, 11 Oct 1935, *Hinton 8345* (F, GH, MO, NY, US); near Ozumba, 8000 ft, 3 Nov 1902, *Pringle 11329* (CAS, ENCB, F, GH, MICH, MO, MSC, US); cool slopes, Sierra de las Cruces, 9500 ft, 12 Sept 1904, *Pringle 13120* (CAS, F, GH, MICH, US); open woods, Salto de Agua, Nov 1905, *Purpus 1762* (F, GH, MO, NY, US); **Distrito Federal:** open grassy roadbank, at La Cima Station between Mexico and Cuernavaca, 3035 m, 25 Sept 1961, *Beaman & Andresen 4534* (GH, TEX, US); Sierra de Ajusco, 9 Nov 1903, *Pringle 11842* (CAS, F, GH, MICH, MO, MSC, US); alrededores de la Estación La Cima, Serranía del Ajusco, 3000 m, 25 Nov 1966, *Rzedowski 23192* (DS, ENCB, MICH, MSC, TEX) **Morelos:** pine forest, Sierra de Morelos near Cuernavaca, 2100 m, 25 Dec 1969, *Hinton 17427* (DS, ENCB, MICH); **Tlaxcala:** Cerro La Hoyanca, cerca de Calpulalpán, 9 Sept 1956, *Paray 2102* (ENCB). **Puebla:** open volcanic slopes, San Manuel de la Sierra, 9300 ft, 19 Aug 1938, *Balls 5296* (GH, MSC, US); Esperanza, Aug. 1907, *Purpus 2697* (F, MO, US); roadside bank between La Venta and San Martin, 8200 ft, 15 Nov 1944, *Sharp 441638* (GH, MO, NY). **Guerrero:** forests N slope of Cerro Alquitrán, 10–14 km by road W of Mexican Hwy 95 and Mazatlán, 2250–2450 m, 6 Dec 1966, *Anderson & Laskowski 4407* (DUKE, ENCB, GH, MICH, NY, US); pine forests, Pilas, Dist. Mina, 1500 m, 22 Nov 1936, *Hinton 9886* (GH, NY, US); pine forests, San Antonio—Buenos Aires, Dist. Montes de Oca, *Hinton 11695* (GH, LL, NY, PH, US); open pine forests, Teotepec, Distr. Mina, 3600 m, 17 July 1939, *Hinton 14463* (DS, ENCB, F, GH, MICH, NY); pine forest slope, Petlacala, Distr. Mina, 1820 m, *Mexia 8963* (CAS, F, GH, MO, NY, US); Chichihualco, El Asoleadero, 15 km al oeste de Camotla, 2650 m, 2 Dec 1963, *Rzedowski 18055* (DS, ENCB, MICH, MSC).



**Oaxaca:** grassy ridge and meadow in pine forest, 26 miles SSE of Miahuatlán, 2600 m between Oaxaca and Suchixtepec on road to Puerto Angel, 7 Nov 1966, *Anderson & Laskowski 4156* (DUKE, ENCB, GH, MICH); SW slope of Cerro Zempoaltepetl along trail from Tlahuitoltepec to Santo Domingo Alberradas, oak forests, about 2000 m, 14 Aug 1950, *Hallberg 967* (ENCB, MICH, US); Sierra de San Felipe, 8000 feet, *Smith 665a* (F, MICH, MO, NY, US). **Chiapas:** on steep moist slope along Mexican Hwy 190, 2 km W of Navenchauk, 6000 ft, 19 Dec 1964 *Breedlove 7974* (DS, ENCB, F, MICH); steep slope, barrio de Tuk paraje of Matsab, Municipio Tenejapa, 7500 ft, 30 Sept 1965, *Breedlove 12517* (DS, ENCB, LL, MICH, US); Mt. Tacaná, 1000–2000 m, Aug 1938, *Matuda 2473* (F, GH, LL, MICH, NY); grassy slope S of the center of Amatenango del Valle, 6100 feet, 11 Nov 1966, *Alush Shilom Ton 1508* (DS, ENCB, MSC, NY, US).

2. ***Halenia recurva*** (J. E. Sm.) C. K. Allen, *Ann. Missouri Bot. Gard.* 20: 161. 1933.

*Swertia recurva* J. E. Smith, *Rees' Cyclopaedia* 34: [under *Swertia*.] 1819. TYPE: Mexico: locality unknown, *Escalante s.n.* by *Mutis 38* (LINN, not seen).

*Halenia rothrockii* A. Gray, *Proc. Amer. Acad.* 11: 84. 1876. TYPE: Arizona; Mount Graham, at 9000 ft, *Rothrock s.n.* (GH, HOLOTYPE, not seen).

*Tetragonanthus rothrockii* (A. Gray) Heller, *Catalogue N. Amer. Pl.* 6. 1898.

Annual herbs with quadrate, narrowly winged stems basally unbranched although often branched above, (1.2)2.5–6.5 dm tall. Basal leaves (0.8)1–2.5(3.0) cm long, 3–6 mm wide, elliptic or elliptic-lanceolate to spatulate; cauline leaves remote, lance-linear to linear, 1.5–4(–7) cm long and 1–3(4) mm wide, obscurely 3-nerved above and only the midvein prominently elevated beneath. Inflorescence a loosely flowered, sub-umbellate cyme; pedicels slender, 0.5–3 cm long. Calyx-tube campanulate to turbinate, 1–1.4 mm high; calyx-lobes lanceolate to linear, acute, 4–8 mm long and 0.8–1.2(–1.5) mm wide, marginally very minutely papillate; corolla bright yellow, about 0.8–1.2 cm long, tube less than half the length of the corolla, lobes ovate, acute to subacuminate, delicately veined, papillate, spurs strongly outwardly curved, mostly horizontal but distally strongly ascending, 0.8–1.6 cm across from spur-tip to tip or each spur mostly (4–)6–8 mm long; filaments slightly obovate, anthers broadly oblong, mucronate, papillate. Capsule lance-ovoid (8–)10–16 mm long; seeds yellow-brown, subglobose-ovoid, granular.

**DISTRIBUTION:** mountains of the southwestern United States (Arizona and New Mexico) and Mexico (Sonora, Chihuahua, Coahuila and Durango) apparently above 7500 ft (= c. 2300 meters).

One is startled to read in Allen's revision of the genus (1933, p. 162) that the type of *Swertia recurva* J. E. Smith is a "specimen



collected by Mutis and sent to Linnaeus, now preserved in the herbarium of the Linnaean Society. . . .” Since there is no evidence that Mutis ever collected in Mexico, suspicion is aroused that the Mutis collection upon which *Swertia recurva* is based belongs in all probability to a South American species. There is, however, a specimen “*Mutis 38*” at US which was obtained from the Madrid Botanic Garden in 1932. J. E. Smith originally reported that the plants were collected in Mexico by Escallon and a specimen sent to Linnaeus by Mutis. This seems to be a plausible explanation of how a specimen from northwestern Mexico was described by J. E. Smith as *Swertia recurva* at such an early date.

REPRESENTATIVE MEXICAN COLLECTIONS: **Coahuila:** 25 km NW of Fraile on top of mountain covered with *Abies*, *Pseudotsuga* and *Pinus*. . . 3550 m, 16 July 1941, *Stanford et al 453* (DC, GH, MO, NY). **Chihuahua:** open pine slope, 69 miles from Parral along road to El Vergel, 8200 feet, 7 Oct 1959, *Correll & Gentry 22882* (ENCB, LL, MO); pine woods, Cajurichi, Río Mayo, 7200 ft, 13 Sept 1936, *Gentry 2711* (F, GH, MO); stony pine woods near First Meadow, Sierra Madre Occidental, 2250–2300 m, 23 Sept 1934 (F, GH, MICH, NY, US); cool slopes, Sierra Madre, 24 Sept 1887, *Pringle 1329* (DS, F, GH, NY, PH, US); Sierra Madre near Colonia Garcia, 8000 ft, 6 Sept 1899, *Townsend & Barber 309* (F, GH, MO, NY, US). **Sonora:** pine zone, Las Tierritas del Temblor, region of Río de Bavispe, 20 Aug 1940, *Phillips 648* (GH, LL, MICH). **Durango:** barranca below Sandia Station, 6500 ft, 13 Oct 1905, *Pringle 13588* (CAS, F, GH, LL, MICH, MSC, TEX, US).

### 3. *Halenia crumiana* Wilbur, *sp. nov.*

Herba annua vel biennis, 3–4.5 dm alta. Radix palaris. Folia basalia ± rosulata; lamina lance-elliptica vel elliptica, 3–4 cm longa et 6–10 mm lata, petioli 1–1.5 cm longi. Folia caulina elliptica 1.5–3.5 cm longa et ca. 4 mm lata, internodiis 1–5-plo longioribus. Lobi calycis lineares vel anguste oblanceolati, acuti, 4–6 mm longi et 0.8–1 mm lati. Lobi corollae oblongi vel ovati vel orbiculares, 4–6 mm longi et 0.8–2(2.2) mm lati; calcaria corollae 5–7 mm longa, ± pendula, paulo divergentia.

TYPE: MEXICO: Jalisco; cypress-pine forest in mountains E of Manantlán about 15 miles SSE of Autlán by way of Chanté. 30 July 1949. *R. L. and C. R. Wilbur 1981* (MICH; 6 duplicates were also collected but were not encountered during this study).

Probably an annual herb from a strong taproot 4–5 mm in diameter and with a weakly 4-angled stem 3–4.5 dm tall and this either little-branched or branching from near the base or even sparingly branched throughout with the stems very slightly winged. Basal leaves apparently at least sometimes rosulate or with



internodes only 2–3 mm long and these leaves lance-elliptic to elliptic with a petiole 1–1.5 cm long and a blade 3–4 cm long and 6–10 mm wide; cauline leaves rather remote with the internodes 1–5 times as long as the leaves, narrowly elliptic, 1.5–3.5 cm long and about 4 mm wide, 3-nerved but only the midvein prominently elevated beneath. Inflorescence of subumbellate cymes terminating the main stem and the lateral branches (and these often very much foreshortened); pedicels stiff,  $\pm$  4-angled and very narrowly winged, ascendent, 5–10 mm long. Calyx-tube campanulate, about 1–1.5 mm high; calyx-lobes linear to narrowly oblanceolate, acute, 4–6 mm long and 0.8–1 mm wide, microscopically marginally papillate; corolla greenish distally but yellowish below including the spurs, 8–12 mm high, the tube about 1/3 the height of the corolla, the lobes broadly oblong to ovate or almost orbicular, broadly rounded to obtuse but occasionally shortly apiculate, marginally erose, the spurs outwardly divergent especially distally but still  $\pm$  pendent, slender, medially usually less than 0.5–0.8 mm in diameter, mostly 5–7 mm long; anthers yellow, broadly oblong, about 1 mm long, the filaments green, linear, slender, spreading ciliate for the basal half. Capsule lance-ovoid, 9–12 mm long; seeds yellowish, subglobose to oblongoid, smoothish.

**DISTRIBUTION.** Known only from the higher mountains of the state of Jalisco, Mexico at an elevation of above 2500 m in rather open forests of pine, fir, cypress, oaks and various other hardwoods.

This species has in the past been identified with *Halenia recurva* (J. E. Sm.) C. K. Allen (= *H. rothrockii* A. Gray), a species found high in the mountains of southern New Mexico and Arizona as well as the Mexican states of Sonora, Chihuahua, Coahuila and Durango. *Halenia recurva* differs in its narrowly linear leaves and widely divergent corolline spurs that are often  $\pm$  horizontal. The cauline leaves of *H. crumiana* are narrowly elliptic and the spurs, although divergent, never approach being horizontal.

The species is named in honor of the accomplished bryologist Howard A. Crum, a much-admired friend. He was a companion on a collecting trip in the summer of 1949 spent in the vicinity of Autlán in the Mexican state of Jalisco. The summer apparently was not bryologically richly rewarding but he endured it in good humor or at least what passed for such among those gifted complainers, the Wilbur brothers. The mountains in which this species of *Halenia* grows are (or were) clothed in some of the most handsome forests in



that part of Mexico with large fir, cypress and pines. We spent a most delightful week collecting in then relatively undisturbed forest.

SPECIMENS EXAMINED: **Jalisco:** Volcán Tequila, due S of Tequila, woods of *Quercus*, and also *Pinus* and *Arbutus*, 1.1 miles from summit on road from Tequila, 2610 m, occasional in shade, 11 Aug 1968, *W. R. & C. Anderson 5125* (DUKE, ENCB, MICH); Sierra de Manantlán (15–20 miles SE of Autlán) near Aserradero El Cuartón, 2500 m; steep slopes near summits, in pine-oak-fir forests, 2 Nov 1952, *McVaugh 13844* (MICH); Sierra de Tequila, 8000 ft, 5 July 1893, *Pringle 5465* (GH); hardwood pine-fir forest in mountains E of Manantlán about 15 miles SSE of Autlán by way of Chante; about 8300 ft, 25 July 1949, *R. L. & C. R. Wilbur 1834* (MICH), *1872* (MICH), 30 July 1949, *R. L. & C. R. Wilbur 1981* (MICH).

4. ***Halenia palmeri*** A. Gray, Proc. Amer. Acad. 21: 401. 1886.

TYPE: MEXICO; Chihuahua, mountain summits above Batopilas, 8850 feet, *Palmer 359* (GH, HOLOTYPE, not seen; NY! PH! US! ISOTYPES).

*Tetragonanthus palmeri* (A. Gray) Kuntze, Rev. Gen. Pl. 2: 431. 1891.

Annual herb; stems simple or little branched and then mostly above and only occasionally from the base, striate, more or less terete, 3–7.7 dm tall. Cauline leaves linear, acute, sessile, faintly 3-nerved, mostly 2–4.5(7) cm long and 2–4 mm wide; lower leaves oblanceolate to linear-lanceolate, acute to obtuse. Inflorescence racemosly cymose, loosely few- to many-flowered. Calyx lobes (4–)7–12 mm long and 1–2.5 mm wide, lanceolate to long-triangular, acute, 3-nerved with the midrib prominent, marginally minutely papillate; corolla 1.0–1.8(–2.2) cm long, deeply yellowish, the tube 7–10 mm long, the lobes broadly ovate, acute, slightly auriculate, papillate and the spurs pendulous, tapering, distally incurved, 1/4 length of the corolla, about 4–5(–7) mm long. Filaments linear; anthers oblong. Capsules 12–15(–22) mm long, ellipsoidal, attenuate, subfalcate; seeds globose, dark brown, granular.

DISTRIBUTION: mountains of northern and central Mexico (Chihuahua and Durango).

*Halenia palmeri* is one of the most easily recognized and distinctive endemic Mexican species.

REPRESENTATIVE MEXICAN COLLECTIONS: **Chihuahua:** La Rocha, along tributary of Río del Soldado, on N-facing conifer slope, Sierra Mohinora, 14–15 Oct 1959, *Correll & Gentry 23120* (ENCB, LL); Memilichi, Río Mayo, on drier slopes, 11 Sept 1936, *Gentry 2686* (F, GH, MO, US); Marsh Lake, Sierra Madre Mts., 7000 ft, 19 Sept 1903, *M. E. Jones s.n.* (DS, GH, MO, US); Madera Municipio, scattered in open pine



forest, Arroyo Negro, 7 miles SW of Chuhuichupa, 8 Oct 1939, *Muller 3705* (GH, LL, MICH); Sierra Madre 60 miles S of Guadalupe y Calvo, 7500–8500 ft, 20 Aug 1898, *Nelson 4798* (GH, US); Sierra Madres near Colonia Garcia, 7500 ft, 4 Sept 1899, *Townsend & Barber 303* (F, GH, MICH, MO, NY, US). **Durango:** common in wet meadow and into pine woods about 2 km E of La Ciudad, 8300 ft, 5 Oct 1970, *Bates, Blanchard & Fryxell 1527* (CAS, ENCB, MICH); high mountain meadows 6 miles E of La Ciudad, W of El Salto, ca. 9000 feet, 20 Oct 1964, *Bratz M680* (GH); steep slope with *Pseudotsuga*, *Abies*, *Pinus*, *Quercus*, *Arbutus* and *Juniperus*, 54 miles N of Estación Coyotes along a lumber road just NW of Guachichilas, 9000 ft, *Breedlove 18799* (CAS, MICH); steep moist slope with *Pinus*, *Quercus*, *Arbutus* and *Juniperus* along Mexican Hwy. 40, 6 miles W of La Ciudad, 8800 ft., 7 Nov 1970, *Breedlove 18866* (CAS, MICH, MO); Sierra Madre Occidental, Mex. Highway 40 12.9 km WSW of El Salto, 2.4 km W of Lecherias (23° 43' N, 105° 29' W), 2520 m, 6 Sept 1975, *N. H. Holmgren & Lowrey 8073* (NCU, NY); Sierra Madre Occidental, about 10 mi W of El Salto on the Durango-Mazatlán Hwy., rocky rhyolitic hillsides and wet depressions in open rolling pine woodlands, abundant in meadows and occasional in forests 2650 m, 2 Oct 1962, *McVaugh 21741* (CAS, LL, MICH, NY); common in wet meadows 2 miles E of La Ciudad on road from Durango to Mazatlán, 8400 feet, *Mason 2934* (F, NCU, NY, PH, TEX); in the more moist openings of the pine forest, about 9100 ft, 30 Sept 1953, *Ownbey 1991* (F, GH, MICH, NY, US); grassy edge of marsh, El Salto (Aserraderos) Sierra Madre Occidental, 2530–2540 m, 28 Aug 1934, *Pennell 18286* (F, GH, MICH, NY, PH, US); marshy glade in pineland, El Salto (Aserraderos), 2600–2650 m, 1 Sept 1934, *Pennell 18551* (GH, NY, PH, US); moist grassy flats along a brook in the forest belt of the Sierra Madre 5 mi W of El Salto, 7800 ft, *Ripley & Barneby 13987* (CAS, NY).

5. ***Halenia konzattii*** Greenm., *Fieldiana Bot.* 2: 335. 1912. LECTO-TYPE: MEXICO: Oaxaca, Cerro San Felipe, Distrito del Centro, 2000 m, 20 Sept 1918, *Konza 2295* (F!).

Erect, usually branching above, probably biennial herbs with rather coarse angular, striate or very slightly winged stems 2.0–3.5(5.0) dm tall. Basal leaves ovate-elliptic with petioles nearly as long as the blade or even longer; cauline leaves shortly winged petiolate or sessile, elliptic, lanceolate, ovate, acute to obtuse, 1–4 cm long and 0.5–1.3 cm wide, 3-nerved, marginally papillate. Inflorescence terminal or terminating axillary branches; pedicels 3–15(–20) mm long, 4-angled, smooth to inconspicuously but copiously papillate. Calyx lobes spatulate, obtuse to rounded, 3-nerved, marginally papillate, 4–6.5(8.0) mm long and 2–3 mm wide; corolla 8–12 mm long and 4–7 mm in diameter, green or yellowish green, the lobes 3–5 mm long, ovate, acute, papillate; spurs slender, pendulous and distally incurved, 1.5–3 mm long. Stamens 2–5 mm



long, the filaments linear, the anthers broadly ovate. Capsule 1–1.8 cm long, lanceolate, subfalcate; seeds globose to ovoid, yellow-brown, granular.

**DISTRIBUTION:** Common in the higher mountains of Oaxaca, Mexico.

This distinctive species is readily identified by its broadly spatulate calyx lobes.

**REPRESENTATIVE SPECIMENS:** **Oaxaca:** pine-oak forest along road from Oaxaca to Guelatao de Juárez and Tuxtepec, 11.2 miles N of intersection with Mexican Hwy. 190, 2410 m, 18 July 1968, *W. R. & C. Anderson 4826* (ENCB, MICH); Cerro Grande de Huancliela, Dist. de Nochixtlán, 2520 m, 13 Oct 1921, *Conzatti 4265* (US); between Mitla and Cuesta, 30 Jan 1966, *Ernst 2365* (US); S facing slopes along Hwy from Oaxaca to Tuxtepec in pine and madrone forest with *Lupinus*, 12.3 miles N of Jct. 190 & 175 on 175, 15 Aug 1975, *LeDoux, Dunn & Wallace 2233* (ENCB, MO, NY); vicinity of Cerro San Felipe, 9500–11000 ft, *Nelson 1115* (GH, US); 18 miles SW of the city of Oaxaca, 7500–9500 ft, 10–20 Sept 1894, *Nelson 1340* (US); Sierra de San Felipe, 10,000 ft, 15 Sept 1894, *Pringle 4908* (ENCB, GH, MICH, MO, MSC, NY, PH, US); Sierra de San Felipe, 10,000 ft, 1 Sept 1894, *C. L. Smith 236* (MO) and also *664* (F, NY) and *665* in part (MO).

## 6. *Halenia schiedeana* Griseb., Gen. & Sp. Gent. 327. 1839.

*Swertia Michauxiana* sensu Schlecht. & Cham., Linnaea 5: 122. 1830 but not Schultes, Syst. Veg. 6: 130. 1820.

*Tetragonanthus Schiedeanus* (Griseb.) Kuntze, Rev. Gen. Pl. 2: 431. 1891.

*Halenia chlorantha* Greenm., Proc. Amer. Acad. 41: 240. 1905. TYPE: Mexico; Hidalgo, wet woods near Trinidad Iron Works, 5700 ft, *Pringle 8939* (F! HOLOTYPE; CAS! ENCB! MO! MSC! NY! PH! US! ISOTYPES).

Annual herb with erect, striate to narrowly winged, terete to weakly 4-angled stems 2–6.5 dm tall, frequently branched above but simple below. Basal leaves with ovate to broadly elliptic blades about 2–3 cm long and 10–18 mm wide with petioles 1–3 cm long or about as long or longer than the blades; cauline leaves ovate to broadly lanceolate, 3–6 cm long and 1.5–2 cm wide, acute to strikingly apiculate, 3–5 nerved, shortly to moderately petiolate with the petioles mostly 3–12 mm long. Inflorescence cymose, terminating the main stem and the axillary branches; pedicels erect, 7–15 mm long, narrowly winged and minutely papillate. Calyx lobes lance-elliptic, marginally densely but microscopically papillate, about 3–5 mm long and 1.5–2.5 mm wide, 3-nerved, acute to even strikingly apiculate, usually strongly reflexed; corolla 8–11 mm long, greenish, the tube almost equaling the obovate, abruptly acuminate, often



papillate lobes, the spurs 2–3 mm long, pendulous, tapering, nearly parallel with the tube, distally slightly incurved. Anthers 2 mm long; filaments linear. Capsule oblong, subfalcate, about 10–15 mm long; seeds globose, yellow-brown, granular.

**DISTRIBUTION:** Moist montane forests of Central Mexico.

**REPRESENTATIVE SPECIMENS:** **Durango:** steep slopes at base of Espinazo del Diablo, 4 km NW of Los Angeles along road between Mazatlán and Durango, 2500 m, 28 Oct 1973, *Breedlove 35749* (CAS); Arroyo del Infierno, deep, well-watered, rough rocky canyon west of Santa Barbara, about 20 km S of El Salto, 2550–2650 m, 23 Aug 1963, *Gordon 54* (MICH); 78.8 miles E of Villa Union, El Espinazo del Diablo, rocky hillsides with pines, about 7400 feet, 3 Sept 1967, *Oliver, Austin, MacBryde 807* (MO); Metates, N of Cueva, Sierra Madre Occidental, along stream, 2600–2650 m, 29–30 Aug 1934, *Pennell 18448* (GH, PH, US). **Hidalgo:** wet woods near Trinidad Iron Works, 5700 ft, 11 July 1904, *Pringle 8939* (CAS, ENCB, F, MO, MSC, NY, PH, US). **Veracruz:** in the pedregal of Las Vegas but near La Joya, 7000 ft, 25 June 1945, *Sharp 45563* (GH); Plan de Cedeño, Municipio de Acajete, 1750 m, 25 Feb 1981, *Ventura A. 18240* (ENCB).

7. ***Halenia alleniana*** Standl. ex Wilbur, *sp. nov.*

Herba annua vel biennis, 3–5 dm alta. Folia basalia oblonga vel oblanceolata, 3–5 cm longa et 8–18 mm lata; petioli indistincti, ± alati, 1–1.5 cm longi. Folia caulina oblonga vel oblanceolata; lamina 3–5 cm longa; petioli indistincti, alati, 1–1.5 cm longi. Lobi calycis lance-lineares vel late elliptici, 4–7 mm longi et 2–4 mm lati, acuti, erecti. Lobi corollae late oblongi, acuti; calcaria corollae 2–4 mm longa pendula, distaliter incurva.

**TYPE:** MEXICO: Nuevo Leon; Cerro Potosí, NE side of mountain at abandoned sawmill site, about 2800 m, in open pine forest, 13 Sept 1960, *Beaman 4481* (GH, HOLOTYPE; MSC & US, ISOTYPES).

Annual herb with an erect, ridged to very narrowly winged, weakly 4-angled stem 3–5 dm tall, usually branched above but not below. Basal leaves with oblong to oblanceolate blades 3–5 cm long and 8–18 mm wide and gradually tapering to the stem or with rather indistinct winged petioles 1–2 cm long; cauline leaves oblong to oblanceolate with the blade 3–5 cm long and tapering to the rather broad base or very indistinctly petiolate and the petiole strongly winged and about 1–1.5 cm long, the blade apically acute and conspicuously veined when dry with 3–5 veins arising from near the base. Inflorescence cymose, terminating the main stem and the axillary branches; pedicels strongly ascendent, mostly 1–3 cm long, narrowly winged and microscopically papillate. Calyx lobes lance-



linear to more typically broadly elliptic, marginally minutely papillate, about 4–7 mm long and 2–4 mm wide, acute, erect; corolla 10–14 mm long, broadly cylindrical, the tube about half as long as the entire corolla, the lobes broadly oblong, acute, the spurs 2–4 mm long, pendent to, somewhat divergent, conical, occasionally distally slightly incurved. Anthers 1.5–2 mm long; filaments 5–7 mm long, slender. Capsule ellipsoidal, subfalcate, about (12)15–25 mm long, tapering to the 2–3 mm apex from the 6–8 mm base; seeds oblongoid, turgid, about 0.8–1 mm long and slightly less, yellowish to pale reddish brown, smooth.

**DISTRIBUTION.** Oak and pine forests in the high mountains of the Mexican states Nuevo Leon, Morelos and Michoacán.

*Halenia alleniana* has had a confused history in the Mexican flora as the relatively few collections made have been attributed to *H. brevicornis* var. *latifolia*, *Halenia deflexa* (J. E. Sm.) Griseb. which is otherwise known only as a transcontinental species across southern Canada and the northern United States, and to an indicated but unpublished species by Paul Standley. More recent collections, especially those made by John Beaman on Cerro Potosí in Nuevo Leon, have convinced me that Standley was correct. Careful and extensive collecting is very much needed in much of Mexico.

This species is named in memory of Dr. Caroline K. Allen who published a revision of this most difficult genus fifty years ago and thus provided the basis for this and all subsequent investigations.

**SPECIMENS EXAMINED:** **Nuevo Leon:** Cerro Potosí; NE side of mountain at abandoned sawmill site, about 2800 m, in open pine forest, 13 Sept 1960, *Beaman 4481* (GH, HOLOTYPE; MSC & US, ISOTYPES); on moist gravelly arroyo bank, the Cañon below Las Cañoas on Cerro Potosí, Municipio de Galeana, 20 July 1935; *Mueller 2233* (F, GH, MICH); in ponderosa pine forest near microwave station on Cerro Potosí N of Galeana, Sept 1970, *Norris 17610* (CAS); **Morelos:** Valle del Tepeite, 16 Oct 1937, *Lyonnet & Elcoro 1796* (US); Tres Marias Mts, 9500 ft, 16 Dec 1907, *Pringle 13971* (GH, US); **Michoacan:** Morelia, Rincón, 2300 [meters], IV 1909, *Arsène 37* (US).

8. ***Halenia alata*** (Mart. & Gal.) Hemsl., Biol. Centr. Amer. Bot. 2: 351. 1882.

*Exadenus alatus* Mart. & Gal., Bull. Acad. Brux. 11: 372. 1844. TYPE: Mexico; Vera Cruz, "Se trouve dans les forêts et sur les rochers trachytiques du pic d'Orizaba, de 9 a 11,000 pieds *Galeotti 7221* (BR, HOLOTYPE, not seen; photo of holotype seen at MO).

*Tetragonanthus alatus* (Mart. & Gal.) Kuntze, Rev. Gen. Pl. 2: 431. 1891.



Perennial herbs from a thickened caudex with 1–several, simple, erect, slightly winged and often quadrate stems (0.3)1–1.5(2.4) dm tall. Basal leaves numerous and crowded, mostly 2–5 cm long and 3–4 mm wide, obtuse, very narrowly oblanceolate, 3-nerved, tapering basally into an elongate, slender petiole; lower cauline leaves sessile and almost twice as long as the basal, upper cauline leaves linear, obtuse, sessile, 1–1.8 cm long and mostly 1–3 mm wide. Inflorescence an umbellate cymose cluster of slightly nodding flowers; pedicels 4-winged or angulate, (1)4–12(15) mm long. Calyx tube turbinate to shallowly campanulate, 0.4–0.6(1.0) mm long, 4-angled; calyx lobes slightly shorter than the corolla, oblong, 3-nerved, occasionally minutely but inconspicuously papillate, acute, 3–4.2(5.5) mm long and 1–1.8(–2.2) mm wide; corolla yellow, almost rotate, 4.5–6 mm long, the tube about 1/3–1/2 as long as the corolla, the lobes ovate to oblong, obtuse but often apiculate, erose, 3–4.5 mm long; spurs lacking but represented by short pouch-like glandular protuberances and these basal nectariferous pouches slightly protruding and drying darkish brown; filaments linear, the anthers ovate to oblong. Capsule broadly ovoid to lance-elliptic, (4.5)6–7(9) mm long; seeds yellow-brown, globose, granular.

**DISTRIBUTION.** High alpine meadows of Mexico and Guatemala. *Halenia alata* is a most distinctive species with short pouch-like nectariferous protuberances instead of spurs.

MEXICAN COLLECTION: Mt. Orizaba, 3000–3125 m, Aug 1839, *Linden 934* (MICH).

9. ***Halenia pringlei*** B. L. Robinson & Seaton, Proc. Amer. Acad. 28: 113. 1893. TYPE: Mexico, springy meadows, Sierra de las Cruces, *Pringle 4209* (GH! HOLOTYPE; CAS! F! G! GH! MO! MSC! NY! PH! US!. ISOTYPES).

*Halenia crassiuscula* B. L. Robinson & Seaton, Proc. Amer. Acad. 28: 113. 1893. TYPE: Mexico; bare alpine summits, Nevado de Toluca, 14,000 ft, *Pringle 4229* (GH! HOLOTYPE; ENCB! MSC! PH! US! ISOTYPES).

*Halenia candida* Ramirez, Inform. Secret. Foment. Mexico 34. 1895. TYPE: Sierra de Las Cruces, June 1895, *Altarmirano s.n.* (US! ISOTYPE).

Perennial herbs with simple to much-branched, ± narrowly 4-angled, erect, slender to compactly bushy stems (2)5–15(27) cm tall from a fleshy taproot 3–4 cm long and 3–6 mm in diameter. Basal leaves present with the blade from narrowly to broadly elliptic to narrowly oblanceolate to even somewhat oblong, about 1–3.5 cm long and mostly 4–9 mm wide, apically acute to obtuse, faintly to



distinctly 3-nerved, tapering into a petiole from about as long as the blade to as short as 1 cm; cauline leaves 1–3 pairs,  $\pm$  linear to narrowly oblanceolate to oblong or elliptic, sessile to basally narrowed, mostly 1.5–3 cm long and 2–5(8) mm wide. Inflorescence a terminal or occasionally also lateral, loose to dense umbellate cyme with  $\pm$  ascendent flowers occasionally slightly nodding after anthesis; pedicels 2–10(20) mm long. Calyx lobes linear to narrowly oblong to oblanceolate (3)4–6 mm long, acute to obtuse; indistinctly 3-nerved and marginally microscopically papillate; corolla white 6–10(15) mm long with the tube 3–4 mm long and the lobes elliptic to oblong-elliptic, acute to acuminate, occasionally slightly erose, the spurs when present 1.5–7 mm long usually strongly divergent and often mostly horizontal with distally upturned tips but often completely lacking or very nearly so especially in late-developing flowers; stamens 2–3.2 mm long, the filaments linear, the anthers ovate to oblong, 0.3–1(1.2) mm long. Capsules lanceolate, frequently subfalcate, acute, exserted beyond the marcescent corolla; seeds  $\pm$  globose, light yellowish brown, granular.

**DISTRIBUTION.** Bare volcanic central Mexican alpine summits and meadows.

Within my concept of *H. pringlei*, as is shown by its very brief synonymy, two long-recognized species have been combined in the present treatment. Both were described by the same authors at the same time and the numerous specimens in the type collections are so dissimilar that one can certainly understand their original decision to recognize two species. The extremes, as is admirably demonstrated by the fine series of specimens collected by Pringle, are so unlike that no one would place them together unless confronted by the specimens that have since accumulated. It must be admitted that the number of recent collections is far less than would be desirable to resolve the question and an opportunity to carefully observe the plants in the field is very much needed. Still I believe that there is no other course now but to combine the two names since I am unable to find even strong tendencies let alone consistent differences to distinguish them.

*Halenia crassiuscula* was described from specimens gathered on “bare alpine summits, Nevado de Toluca, 14,000 ft.” and the plants were as described *i.e.* much-branched, depressed (“2–4 inches in height”) and altogether of the dwarfed aspect that alpine plants often possess. In contrast the type collection of *H. pringlei* is  $\pm$



unbranched and slender. The basal leaves of *H. crassiuscula* are described as oblanceolate and 3-nerved while those of *H. pringlei* are narrowly elliptic to lanceolate and apparently 1-nerved. The difference in venation is one of degree and the distinction disappears when one examines a larger series of specimens. The original descriptions and Allen's key depended greatly upon the supposed obtuseness of the calycine lobes of *H. crassiuscula* in contrast to their acuteness in *H. pringlei* but this distinction is completely blurred when a larger series of specimens is examined. In summary, none of the differences noted or observed holds up. In spite of the striking differences in the extremes, my study has convinced me that at present there is no way in which the two species can be maintained. A larger series of specimens is very much needed and it is surprising how little additional material has accumulated in the past fifty years or since Allen examined the available specimens for her dissertation.

The Flora of Guatemala attributes *Halenia crassiuscula* to the high volcanoes of western Guatemala but I believe that the specimens upon which its presence in that country rests are all stunted or grazed specimens of *Halenia decumbens*, a species which is common there. The corolline spurs of *H. crassiuscula* tend to be much more strongly divergent than the  $\pm$  pendent spurs of *H. decumbens*. The stunted alpine specimens annotated as *H. crassiuscula* in the Flora of Guatemala and illustrated there (Fieldiana Bot. 24(8): 318, fig. 87. 1969) possess the normal corolla of *H. decumbens* which differ markedly from the strongly divergent spurs of *H. pringlei* (including *H. crassiuscula*). The variation of corolline spurs within *H. pringlei* is remarkable. Even in the type of *H. pringlei* the corollas vary from spurless to so strongly divergent as to be mostly horizontal with distally upturned tips but its variability does not extend to the elongate pendent spurs of *H. decumbens* (*s.l.*) so aptly illustrated in the above mentioned figure.

REPRESENTATIVE MEXICAN COLLECTIONS: **Veracruz:** in turf, Cofre de Perote, 14000 ft, 25 May 1938, *Balls 4610* (GH, US); open slopes, Apitza Ixtaccihuatl, 12700 ft, *Balls 5123* (US); in wet meadow E side of Cofre de Perote about 3860 m, 6 Aug 1958, *Beaman 2184* (GH, MSC, US). **Mexico:** Ojos de Agua, Nevado de Toluca, 12500 ft, 9 July 1938, *Balls 4964* (GH, MICH, MSC, US); bog in open sunny glades in forest of *Abies*, El Ricón de Selgado, Nevado de Toluca, 10,000 ft, 13 July 1938, *Balls 5200* (US); shore of large lake in the crater of the Nevado de Toluca, about 4140 m, 26 July 1958, *Beaman 1883* (GH, MICH, MSC, TEX, WIS, US); alpine meadow, S side of



Ixtaccihuatl, 3950–4000 m, 30 July 1958, *Beaman 1953* (MSC); in gravelly soil on rock slide of S wall of the crater of Nevado de Toluca about 4230 m, 2 July 1960, *Beaman 3454* (DUKE, GH, MSC, TEX, US); grassy alpine meadow on W slope S side of Ixtaccihuatl, 6 July 1960, *Beaman 3485* (GH, MSC, TEX); Amecameca, slopes of Popocatepetl between 10,000 and 12,000 ft, 4 July 1943, *Gilly & Dodds 23* (MICH, MSC); alpine zone on SW slope of Volcán Ixtaccihuatl 5–6 km N of Paso de Cortez, *Iltis, Koepfen & Iltis 1009* (MICH, WIS); springy alpine meadows, Sierra de las Cruces, 9800 ft, 28 Aug 1904, *Pringle 13121* (GH, MO, US); wet meadows, Ixtaccihuatl, 12–13000 ft, 1903, *Purpus 318* (MO, US); Palomas, Municipio de Iturbide, 3400 m, 18 July 1968, *Rzedowski 25930* (ENCB, MICH, MSC). **Tlaxcala:** turfy slopes, Mt. Malinche, above San Francisco, 22 June 1938, *Balls 4887* (US). **Distrito Federal:** in alpine meadow top of Cerro Ajusco, 3937 m, 12 July 1959, *Beaman 2776* (MSC).

10. ***Halenia hintonii*** Bullock, Hooker's Icon. Plant. 34: *tab.* 3399. 1939. [as *Hintoni*]. TYPE: MEXICO: Mexico; Distr. de Temascaltepec, Cumbre Trojes in *Pinus* and *Alnus* forest. *Hinton 8273* (K, HOLOTYPE; ENCB! F! GH! UTD! MO! NY! PH! ISOTYPES).

Perennial herb 1.2–3 dm tall with 4-sided, striate to narrowly winged stems. Basal leaves scarcely rosulate, the lowermost long petiolate, spatulate to oblanceolate or elliptic with the blades about 1.5–3(4.5) cm long and 1–1.5(2) cm wide with a rounded apex and tapering into a winged petiole 2–3.5 cm long; cauline leaves either sessile or tapering into an indistinct winged petiole, oblanceolate-elliptic or elliptic or somewhat lanceolate, (2)3–4.5 cm long and about 1 cm wide, apically acute to obtuse or somewhat rounded. Inflorescence a terminal or axillary, 3–7-flowered, umbellate cyme with pedicels quadrate and slightly wing-angled, 0.5–1.5 cm long. Calyx lobes erect, oblong or oblong-spatulate, 3–4 mm long and 1.5–2 mm wide, apically rounded or obtuse, marginally minutely papillate, 3-nerved; corolla white, about (6–)7–9 mm long, the tube 3–4 mm long, the lobes erect, ovate to oblong, 3–5 mm long, 2–2.5 wide, apically often shortly apiculate or occasionally broadly rounded, the spurs about 5–7 mm long, acute, slender, outwardly spreading or very strongly divergent and distally outwardly curved. Stamens included; filaments linear, about 1.5 mm long; anthers reniform-sagittate, about 1 mm long. Capsule thinly cartilaginous, about 1.2 cm long and 4 mm wide, apically often somewhat arcuate, apiculate; seeds ovoid, 16–20 in number, about 1.5 mm long and 1 mm in diameter, smooth, pale yellow.

**DISTRIBUTION.** Known only from the type locality in the state of Mexico.



11. ***Halenia decumbens*** Benth., Pl. Hartw. 67. 1840. TYPE: MEXICO; Oaxaca, "in monte Pelado," *Hartweg 494* (K, HOLOTYPE; G, photo! NY! W, photo! ISOTYPES).
- Halenia longicornu* Mart. & Gal., Bull. Acad. Brux. 11: 370. 1844. TYPE: Mexico; Oaxaca, Croît dans les endroits humides des forêts de pins, chênes et arbousiers du Cerro de San Filipe, pres d'Oaxaca, de 8,500 a 9,500 pieds," *Galeotti 7166* (BR, HOLOTYPE, photo!, MO-fragment!).
- Halenia apiculata* Mart. & Gal., Bull. Acad. Brux. 11: 371. 1844. TYPE: Mexico; Oaxaca, Se trouve avec l'*Halenia longicornu* au Cerro San Felipe, de 8 a 9,000 pieds, *Galeotti 7166* (G, HOLOTYPE).
- Halenia plantaginea* [var.] *apiculata* (Mart. & Gal.) Griseb., Linnaea 22: 45. 1849.
- Tetragonanthus decumbens* (Benth.) Kuntze, Rev. Gen. Pl. 2: 431. 1891.
- Tetragonanthus longicornis* (Mart. & Gal.) Kuntze, Rev. Gen. Pl. 2: 431. 1891.
- Halenia guatemalensis* Loesener, Verhandl. Bot. Vereins. Brandenb. 55: 182. 1913. TYPE: Guatemala; Huehuetenango, Todos Los Santos, road near Chiantla, 3000 m, *Seler & Seler 2728* (B, not seen, probably destroyed).
- Halenia plantaginea* var. *latifolia* Loesener, Verhandl. Bot. Vereins. Brandenb. 55: 182. 1913. TYPE: Guatemala; Huehuetenango, Todos Los Santos, Bergwald Oberh., 2800–3000 m, *Seler & Seler 3086* (B, not seen, probably destroyed).
- Halenia shannonii* Briq., Candollea 4: 320. 1931. TYPE: Guatemala; Sacatepéquez, Volcán de Agua, 12,400 ft. *Shannon* [J. Donnell Smith #] *3613* (G, HOLOTYPE; GH! MO! NY! US! ISOTYPES).
- Halenia shannonii* f. *compacta* C. K. Allen, Ann. Missouri Bot. Gard. 20: 178. 1933. TYPE: Guatemala; Huehuetenango, mountains above Chinantla, *Cook 45* (US! HOLOTYPE).
- Halenia guatemalensis* var. *latifolia* (Loesener) C. K. Allen, Ann. Missouri Bot. Gard. 20: 180. 1933.
- Halenia caleoides* C. K. Allen, Ann. Missouri Bot. Gard. 20: 173. 1933. TYPE: Guatemala; vicinity of Agua, 2700–3000 m, *Maxon & Hay 3675* (US! HOLOTYPE).
- Halenia platyphylla* C. K. Allen, Ann. Missouri Bot. Gard. 20: 173. 1933. TYPE: Guatemala: Sacatepéquez, Volcán Agua, 2875 m, *J. Donnell Smith 2170* (GH! HOLOTYPE; US! ISOTYPE).

Perennial herb (0.5)1.5–3(4.5) dm tall with 1 to several terete to quadrate, often slightly winged stems commonly arising from a basal cluster of leaves and occasionally with elongate leafy offsets. Basal leaves elliptical to broadly oval or lanceolate to oblanceolate or even linear, long petiolate, acute to obtuse, typically 3-nerved but usually only the midvein prominent, (2–)3–6(12) cm long and (3–)6–12(–18) mm wide, acuminate to more typically acute to even obtuse; petiole usually sharply delineated from the blade and often comprising half the length of the leaf; cauline leaves 1–6 pairs,



sessile to more typically the lower tapering into a petiole, 3-nerved although only the midvein prominent, (1.5–)2–4(–12) cm long and 5–15(–20) mm wide, elliptic to oblong-lanceolate or lanceolate, acute to acuminate. Inflorescence an axillary and terminal, umbelliform cyme with usually ascendent to erect pedicels 1–2 cm long. Calyx lobes erect, mostly oblong-elliptic to oblong or rarely oblanceolate, acute to acuminate and occasionally even apiculate, marginally minutely papillate, mostly half to three-fourths as long as the corolla but occasionally as long, 4–7 mm long and 2–2.5 mm wide; corolla mostly (1.0–)1.2–1.8(2.0) cm long, the lobes 1.5–3 mm long, yellowish to yellowish green or even green, broadly ovate to deltoid, usually acute but occasionally acuminate or sometimes obtuse, about as long as the tube, entire to erose, the spurs pendent to moderately divergent, slender, 4–7(10) mm long. Capsule exserted, elliptic to more typically lanceolate, 8–12(–18) mm long and (3–)4–6 mm wide.

**DISTRIBUTION.** grassy alpine slopes, talus slides and open montane woods from southern Mexico (Guerrero, Oaxaca and Chiapas) and western Guatemala (Chimaltenango, Huehuetenango, Quetzaltenango, Quiche, Sacatepéquez, San Marcos, Sololá, Totonicapán) reportedly ranging from 2000–4000(4200) m.

**REPRESENTATIVE MEXICAN COLLECTIONS:** **Guerrero:** open pine forest, Mina, Teotepec, 3600 m, 17 July 1939, *Hinton 14463* (MICH, US). **Oaxaca:** abundant on steep hillside in open *Pinus hartwegii* forest on Cerro Pelong, 25.5 miles E of Ixtlán along the Oaxaca-Valle Nacional Hwy about 2950 m, 21 July 1960, *Beaman 3672* (DUKE, GH, MSC, TEX, US); middle to upper slopes, Zempoaltepetl, Feb 1937, *Camp 2631* (ENCB, F, MICH, NY); in open pine woodland, about 3396 m, vicinity of Cerro Zempoaltepetl, 23 July 1950, *Hallberg 738* (MICH); Cerro de Humo at 10,000 ft, Comaltepec, 19 May 1971, *MacDougal s.n.* (F, NY); in pine and oak forest, Cerro Zempoalteptl, 9500 ft, 6 Aug 1963, *Molseed & Hallberg 300* (MICH); above road on rocky hill, 40 miles S of Valle Nacional, 22 Mar 1978, *Poole, Bain & Kerr 1287* (TEX); floor of dry oak forest, Cerro Cusumulco on northern slope near San Pedro Yolox, 2100 m, 24 June 1939, *Schultes 676a* (GH, MO); rich cloud forest about 29 miles N of Ixtlán de Juárez on Hwy 175 about 2800 m, 18 July 1976, *Stevens, Donoghue & Scott 2475* (ENCB, GH, MSC); Sierra Madre del Sur, cloud forest near top of Cerro Pilon c. 70 mi from Oaxaca, 9000–9100 ft, 20 June 1962, *Webster, Hallberg & K. & L. Miller 11558* (CAS, DUKE, F, GH, MSC, TEX). **Chiapas:** flat meadow and steep slopes on the SE side of the summit of Volcán Tacaná, 3600 m, 3 Mar 1972, *Breedlove 24313* (DS); small meadow near the summit of Volcán Tacaná, 30 July 1972 *Breedlove 26707* (DS); steep dry slope on the SE side of Volcán Tacaná above Talquian, 3500 m, 11 Nov 1972, *Breedlove 29406* (ENCB, DS, LL); steep slope on the N and W slope of Cerro Mozotal below microwave tower along road from Huixtla to El Porvenir and



Siltepec, 3000 m, 19 Sept 1976, *Breedlove 40311* (DS); slopes 5 km N of Mexican Hwy 190 on a logging road from Laguna Chamula microwave station, 2400 m, 15 Oct 1976, *Breedlove 40808* (DS); Siltepec, 9 Aug 1937, *Matuda 1596* (F, GH, LL, MICH, MO, NY, US); in pinelands, Mt. Tacaná, 2000–4038 m, Aug 1938, *Matuda 2346* (F, GH, LL, MICH, MO, NY, US); Mt. Male near Porvenir, 3200 m, 6 July 1941, *Matuda 4706* (GH, LL, MO, NY).

12. ***Halenia plantaginea*** (H.B.K.) G. Don, Gen. Hist. 4: 177. 1838.

*Swertia plantaginea* H.B.K., Nov. Gen. & Sp. Pl. 3: 175. 1818. TYPE: Mexico; in Andibus Mexicanis, *Humboldt & Bonpland s.n.* (P, photograph seen at MO, US).

*Halenia elongata* D. Don ex G. Don, Gen. Hist. 4: 177. 1838. TYPE: Mexico, (K, not seen. Described as an annual).

*Halenia nudicaulis* Mart. & Gal., Bull. Acad. Brux. 11: 371. 1844. TYPE: Mexico; Veracruz, Croît dans les forets humides du haut pic d'Orizaba, de 9 à 11,000 pieds d'élévation absolue Orizaba, *Galeotti 7220* (BR, HOLOTYPE; G, W, ISOTYPES, not seen).

*Halenia nutans* Mart. & Gal., Bull. Acad. Brux. 11: 371. 1844. TYPE: Mexico; Vera Cruz, Croît dans les forêts humides du haut Pic d'Orizaba, de 9 à 11,000 pieds d'élévation absolue *Galeotti 7222* (BR, HOLOTYPE; photograph seen, MO).

*Tetragonanthus plantagineus* (H.B.K.) Kuntze, Rev. Gen. Pl. 2: 431. 1891.

*Halenia purpusi* Brandegee, Zoe 5: 235. 1906. TYPE: Mexico; meadows above timberline, Ixtaccihuatl, *Purpus 1760* (CAS, HOLOTYPE not seen; F! MO! NY! US! ISOTYPES).

*Halenia scapiformis* Briq., Candollea 4: 322. 1931. SYNTYPES: Mexico: Sierra San Pedro Nolasco, Talla, etc. 1843–44, *C. Jurgensen 811 & 812* (G, not seen; photo of 812 seen (MO)).

*Halenia plantaginea* f. *grandiflora* C. K. Allen, Ann. Missouri Bot. Gard. 20: 176. 1933. TYPE: Mexico: Nevado de Toluca, *Pringle 4224* (MO! HOLOTYPE; CAS! F! GH! MO! PH! NY! US! ISOTYPES).

Perennial herb with 1-several, striate to very narrowly winged,  $\pm$  quadrangular, erect stems (0.8)1.5–3.0(4.5 dm tall, usually simple below and often with short, floriferous branches above, arising from a thick fleshy caudex. Basal leaves numerous, rosulate, the blades lanceolate or elliptic to ovate, 3-nerved, 3–10(15) cm long and 0.5–1.5 cm wide, obtuse to acute or even apiculate and with slender petioles (1)2–5 cm long, the cauline leaves 1–2 pairs, sessile, linear to lanceolate or broadly elliptic, (1–)2–3(–4.5) cm long. Inflorescence a terminal or axillary umbellate cyme with slightly curved or nodding slender pedicels (2–)8–18(–22) mm long. Calyx lobes lance-elliptic to oblong to even narrowly spatulate, 2.5–6 mm long, obtuse to acute or rarely even abruptly acuminate, 1/3–1/2 as long as the corolla, 3-nerved, microscopically marginally papillate; corolla yellow, (0.7–) 1–1.7 cm long, the tube slightly shorter than the ovate to



oblong, obtuse to acute lobes, the spurs very slender, pendulous, distally slightly incurved, mostly  $1/3$ – $1/2$  length of corolla, (2)3–5(7) mm long. Filaments linear; anthers ovate. Capsule elliptic to lanceolate in outline, subfalcate, (0.7–) 1.2–1.8 cm long and about 5 mm wide, exserted; seeds subglobose, brown, granular.

**DISTRIBUTION.** Mountains of central and southern Mexico (Vera Cruz, Hidalgo, Mexico, Tlaxcala, Puebla, Michoacán, Morelia and Oaxaca).

The merit of *H. nudicaulis* as a distinct species separate from *H. plantaginea*, although not accepted in this treatment, is still deserving of critical study. The differences noted to differentiate *H. nudicaulis* from its nearest congener are all quantitative. The size of the plant as well as its leaves, corolla and spur length and the size of the capsules are all smaller in *H. nudicaulis* than in *H. plantaginea* and the suspicion is natural that this might well be environmentally induced. Specimens of *Halenia nudicaulis* all come from the upper altitudinal limits of *H. plantaginea s.l.* Opportunity to study populations of these plants in the field might do much to resolve this question. In any event the two are very closely related to one another and my expectation is that further study will demonstrate that *H. nudicaulis* is not specifically distinct.

Specimens thought to be representative of *H. nudicaulis* seemingly were separable from *H. plantaginea* by the following key:

- a) Corolla less than 10 mm long; corolline spurs less than 2.5(–3) mm long; capsule less than 10(–13) mm long .....  
..... *H. nudicaulis*.
- a) Corolla 10 mm long or longer; corolline spurs (2–)3–5(7) mm long; capsule 1.2–1.8 mm long ..... *H. plantaginea*.

I believe the available collections suggest that the specimens referred to *H. nudicaulis* are merely smaller plants usually found in less favorable sites usually at the upper altitudinal range of *H. plantaginea s.l.*

Allen (1933, p. 177) stated in regard to f. *grandiflora* that it “appears to be only a variation due merely to habitat, moisture, or some nutritional factor” and that “it has no distinctive geographical distribution.” From her own observations one would conclude that this variant did not deserve a formal rank. This apparently represents the opposite extreme of variation within *H. plantaginea* than *H. nudicaulis*. Specimens of f. *grandiflora* are seemingly from the more favorable habitats within the range of *H. plantaginea*.



REPRESENTATIVE SPECIMENS: **Tamaulipas:** open rocky slopes of Cerro Linadero [near] Dulces Nombres, Nuevo Leon and just E of border of Tamaulipas-Nuevo Leon, 2450 m, 10 Aug 1948, *Meyer & Rogers 2917* (MO). **Nuevo Leon:** open pine woods, Cerro del Viejo, 15 mi W Dulces Nombres, 18 Aug 1948, *Meyer & Rogers 2971* (MO). **Queretaro:** bosque de Abies, 1 km al SW de la cumbre, Cerro Zamorano, 3100 m, 13 Nov 1971, *Rzedowski & McVaugh 404* (ENCB, MICH). **Hidalgo:** Mt. Orizaba among thin grass in open forests of *Pinus*, 10,500 ft, 18 Aug 1938, *Balls 5281* (GH, MICH, MSC, US). Sierra de Pachuca, 10,000 ft, 22 Aug 1902, *Pringle 11033* (F, GH, MICH, MO, NY, US); S slopes Cerro Jihuingo (19° 49–50' N, 98° 33–34' W), 2750–3250 m, 26 July 1966, *West T-16* (MICH, WIS). **Veracruz:** Los Pescados, Cofre de Perote, 9500 ft, 12 Sept 1938 *Balls 5434* (MSC, US); pine forests, Citlaltepctl, 11–12000 ft, *Purpus 2766* (F, GH, MO, NY). **Mexico:** open pine woods, Ojos de Agua, Nevado de Toluca, 12500 ft, 9 July 1938, *Balls 4963* (ENCB, GH, MICH, US); upper pine belt, Volcán de Zinantecatl near Toluca, about 10,000 ft, 23 Aug 1947, *Barkely, Webster & Westlund 44* (F, TEX, US); open pine forest, NW side of Nevado de Toluca between Loma Alta and Cerro Gordo, 3450 m, 7 Sept 1957, *Beaman 1678* (GH, MSC, TEX, US); in grassy meadow under open pine forest, Telapon N of Iztaccihuatl, S side of mountain, 3450–3650 m, 4 Sept 1958, *Beaman 2435* (GH, MSC, US); forest of pine and fir, Las Cruces, Temascaltepec, 3350 m, 13 July 1932, *Hinton 1034* (F, LL, MO, NY, PH, US); under thick pine, Monte de Río Frio, km 49 road from Mexico City to Pueblo, 4000 m, 31 July 1929, *Mexia 2693* (CAS, MICH, MO, NY, US); springy alpine meadows, Sierra de las Cruces, 9800 ft, 28 Aug 1904, *Pringle 13121* (CAS, MICH, MO); subalpine meadow, Popocatepetl, Sept 1908, *Purpus 3070* (F, GH, MO, NY, US). **Distrito Federal:** Río Frío, 27 Aug 1930, *Russell & Souviron 74* (CAS, GH, US). **Tlaxcala:** in pine and fir forest on N slope of Cerro Matlalcueyetl, 26 Sept 1953, *Sohns 680* (MICH, US). **Michoacan:** in open pine forest, summit of Cerro San Andres, about 12 km N of Ciudad Hidalgo, 3589 m, 6 Sept 1960, *Beaman 4271* (GH, MSC, US); pine forest, Zitacuaro-Cacique, 3325 m, 29 Aug 1938, *Hinton 13175* (F, GH, ILL, LL, MICH, NY, PH, TEX, US); only under pines, summit of Cerro Tancitaro, 12,600 ft, 17 July 1940, *Leavenworth 277* (F, GH, ILL, NY). **Morelos:** pine-fir forest, Lagunas de Zempoala, 29 July 1957, *Straw & Gregory 1071* (MICH). **Puebla:** open forest of *Pinus*, Tasmalaquilla, Mt. Orizaba, 10,500 ft, 18 Aug 1938, *Balls 5281* (GH, MICH, MO, US); in grassy pine forest about 3 miles SE of Villa Hidalgo, Pico de Orizaba, about 3780 m, 15 July 1960, *Beaman 3648* (GH, MSC, TEX, US); in pine forest about 2 km NE of the Paso de Cortez Monument, about 3700 m, 10 Sept 1960, *Beaman 4445* (GH, MSC, US); Mt. Orizaba, 12,000 ft, 6 Aug 1891, *Seaton 205* (F, GH, NY, US). **Oaxaca:** vicinity of Cerro Zempoaltepetl on SE slopes of peak, 2900–3100 m, 10 Aug 1950, *Hallberg 919* (MICH); vicinity of Cerro San Felipe, 9500–11000 ft, *Nelson 1096* (GH, US); Sierra de San Felipe, 10,000 ft, 23 June 1894, *Pringle 4720* (ENCB, GH, MICH, MO, MSC, NY, PH, US).

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